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Enterprise-scale Computation Imaging

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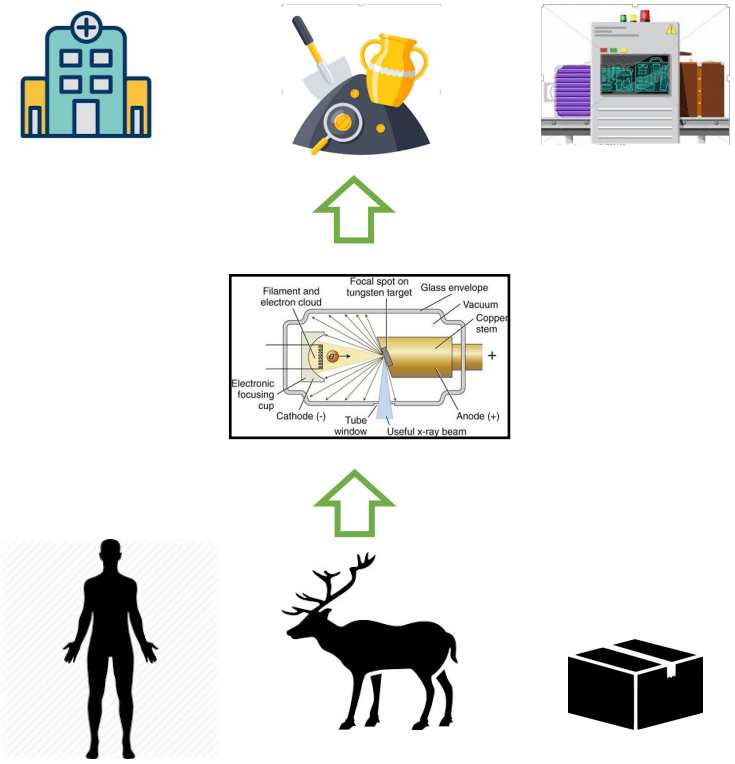
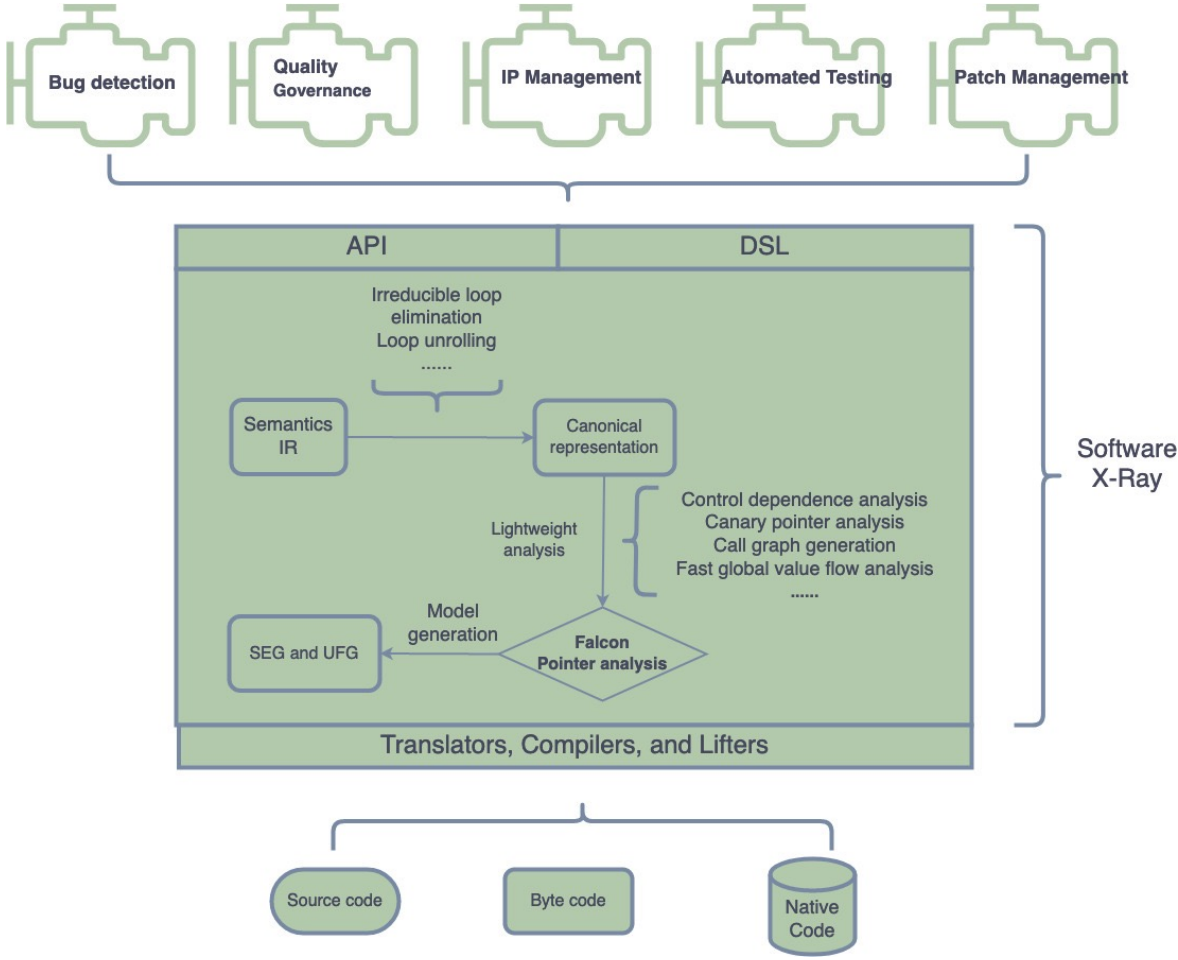
X-Ray Imaging

- Tool for determining physical composition of objects
- Highly revolutionary
  - Pillar of modern medicine
  - Security and safety
  - Archeology
- Non-invasive therefore highly versatile
  - Human body + Animal + objects

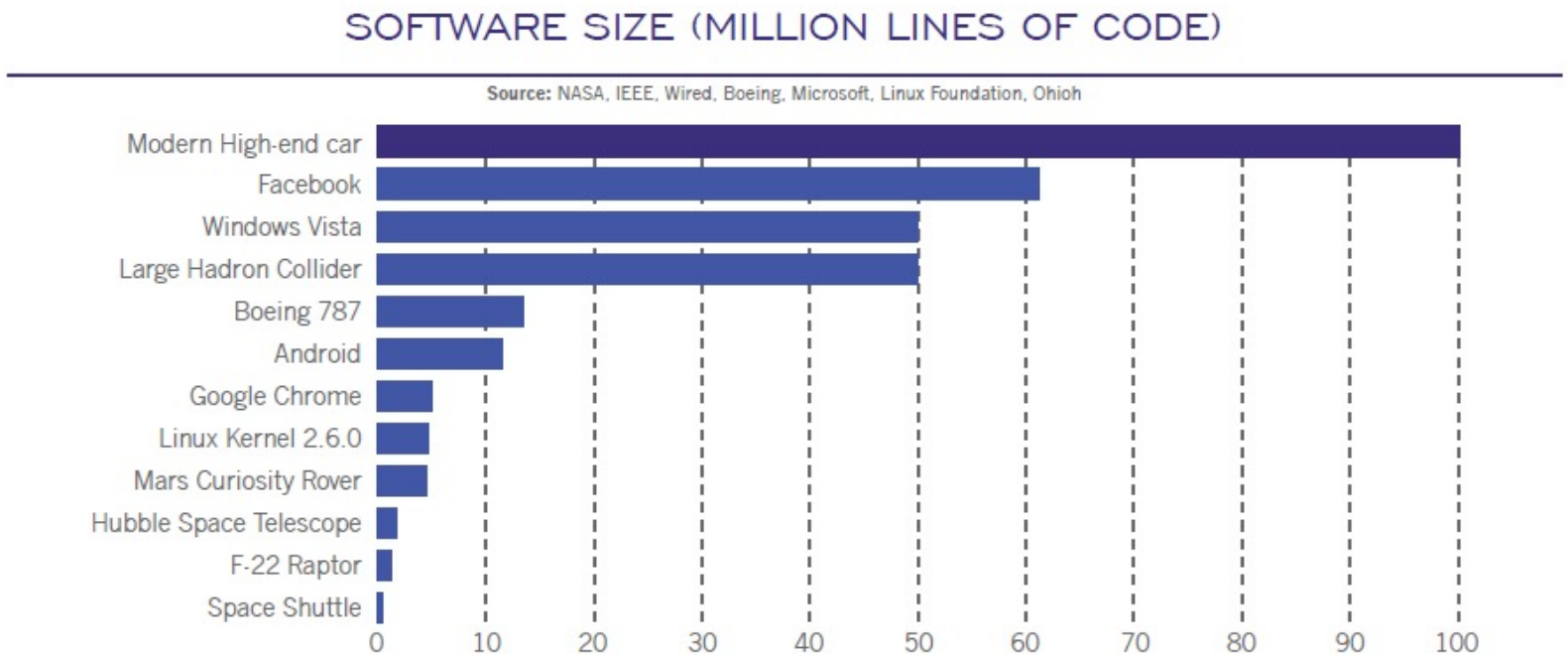


Computation Imaging

- Tool for determining computational composition of software
- (Should be) Highly revolutionary
  - Health of software
  - Security and safety
  - Manufacturing governance
- Need to be non-invasive and highly versatile
  - Source code + bytecode + binary
- This is hardly a new idea, but not easy for enterprise-scale



Enterprise software: Big!



Enterprise software – Alive!

- Linux
  - 2021: 74,902 commits in 319 days ➔ 235 /day == 10 /hour
  - 2020: 90,421 commits in 366 days ➔ 247 /day == 10 /hour
  - 2019: 82,483 commits in 365 days ➔ 225 /day == 9 /hour
- Clang
  - 28,770 commits 319 day => 90 /day == 4 /hour
- Tensorflow
  - 2021: 18,768 commits 319 days => 59 /day == 2 /hour

Enterprise software – Mostly dark!

- Large-scale software supply chains (often in binary)
  - 15%-27% of code is third-party commercial software – so the source is often unavailable.
  - In-house supply chains across groups
- New trend: software evolves into cloud native
  - Amazon lambda deployment increases 200% in 2020[1]
  - Code size including dependency < 25MB
- Most of the parts are “dark”
  - Not developed by you
  - Not directly examined (no source code, no documentation)

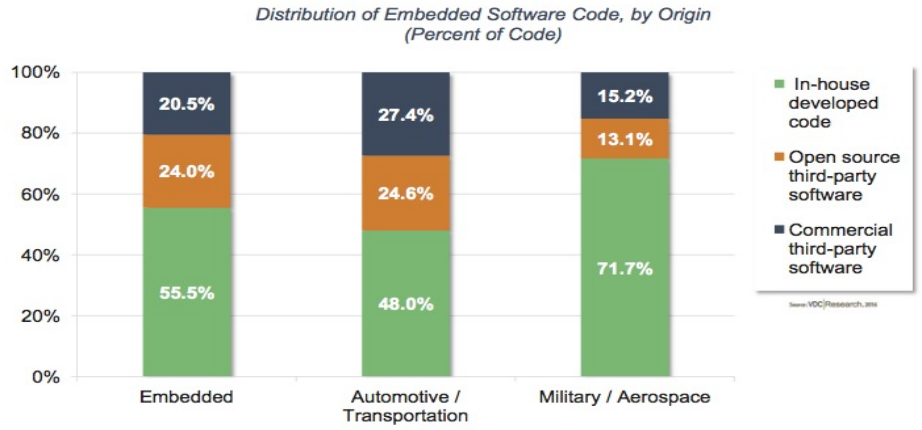


Figure : A graph showing the distribution of code origin for different classes of projects. Source “Software Assembly Practices Necessitate More Precautions” – VDC Research, 2016.

1. https://newrelic.com/resources/ebooks/serverless-benchmark-report-aws-lambda-2020

Enterprise software: Assembled control-flow!

- Componentized deployment
  - Serverless -- “trained developers to optimize Lambda functions for single, well-defined tasks with lower overall code sizes”
  - Micro-service -- “replace their large, cumbersome monolithic applications with microservices”
- Program dependencies cannot be locally reasoned
  - Assembled instead of self-contained
  - Inverted dependences through callbacks
  - Remote dependence via inter-process communication
  - Nobody knows how it works……

Enterprise-scale Computation Imaging

- High quality results:
  - Precise:
    - Balance between false and missing results
  - Fast:
    - Between editor feedback and nightly build
- Address the **CODA** challenges:
  - **C**ONTINUOUS in time (incremental) and space (accumulative)
  - **O**PEN for customization through APIs and DSLs
  - Reasonable assumptions of the "**D**ARK code"
  - Understanding of **A**SSEMBLED program dependency through callbacks or distributed computing

All need to be addressed simultaneously !

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Introducing Clearblue Project

- To build open-source platform for non-invasive computation imaging technology
- Foundation
  - World-leading research results
  - Technology already commercialized and deployed in Huawei, Baidu, Alipay
- Goals
  - A general purpose language-based UI
  - A highly parallel and distributed composition analysis engine
  - A non-invasive software scanning apparatus based on binaries and texts